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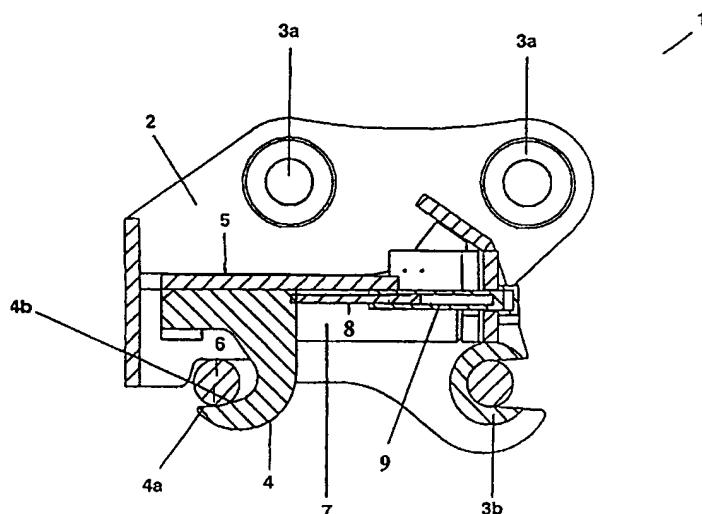
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(54) Title: CONNECTION APPARATUS



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(57) Abstract: This invention relates to a connection apparatus (1) for connecting an implement to a prime mover. The connection apparatus includes a body (2) arranged to be mounted on the prime mover. The body includes a connection means for connecting the body to the implement, the connection means including at least one recess within the body adapted to attach the implement to the connection apparatus. The connection apparatus further includes a locking member (4,5) adapted to move to a first position in which the locking member engages the implement to lock the implement and the body together, and a second position in which the locking member is disengaged from the implement so that the implement can be demounted from the body. The connection apparatus (1) further includes at least one compression piston (8) and chamber (9) which is/are adapted to resist movement of the locking member (4,6) to the second position to thus prevent the implement from being inadvertently demounted from the body. A method of attaching the connection apparatus to an implement and prime mover is also described.

## CONNECTION APPARATUS

TECHNICAL FIELD

This invention relates to improvements in or relating to connection apparatus. More specifically, the present invention may be adapted to provide a connection apparatus or quick hitch for lifting 5 or earth-working or heavy machinery to allow an appropriate or required implement to be easily and/or quickly attached to or replaced from the machinery in question.

For convenience only, reference throughout this specification will predominantly be made to the present invention being adapted to provide an improved quick hitch for an excavator or any other form of lifting or excavating machinery or vehicle. However, it should be appreciated by those 10 skilled in the art that other applications are envisioned for the present invention in that it may also be used with other types of machinery or vehicles if required.

Hence, the prior art and possible applications of the invention, as discussed herein, are given by way of example only.

BACKGROUND ART

15 New Zealand Patent No. 220557/222864 discloses a connector for facilitating the mounting and demounting of a variety of earthmoving implements to a vehicle such as a digger or front-end loader. This connector is useful for speeding up the changing of one implement to another. It includes a body that is mounted on the vehicle and is provided with two recesses in which respective pins mounted on the implement are received in the process of mounting the 20 implement on or to the vehicle. The first of the recesses is provided with a hydraulically operated closure member that retains the first pin in the first recess. The recesses are oriented at right angles to one another and because of this, as long as the first pin is held in the first recess by the closure member, the implement is locked to the connector.

25 New Zealand Patent No. 250811 discloses a connector provided with a closure member which is mounted on a plate that is located in the body. The plate is slidable between a working position

in which the closure member holds the first pin captive in the first recess and a second position in which the closure member is withdrawn from the first recess so that the first pin can pass out of the first recess. The connector further comprises a locking pin arranged, for safety, to be inserted in an aperture in the plate and having tapered faces which engage with the outer end of 5 the aperture and the outer face of an end plate of the body to lock the plate in the working position.

British Patent GB 2205299 describes a similar type of connection apparatus to those discussed in the above two New Zealand patents. This connection apparatus also includes a body with two recesses in which respective pins of an implement are received to mount the implement on an 10 excavator. A spring is used to permanently bias a locking hook in a position where it will close one of the two recesses to trap one of the implement connection pins. A hydraulic ram is provided to push against the force applied by this spring, allowing the hook to be moved back and a pin to be inserted into the recess to mount the implement on the excavator.

However, there are some safety problems associated with these different types of connectors, 15 also known in the industry as quick hitches. If the hydraulically operated closure members fail then there is a danger of the implement falling off the working arm of the excavator. This is a significant safety concern due to the size and weight of the implements attached.

In the case of the quick hitch described in GB 2205299 the biasing spring used would normally keep the implement attached to the end of the working arm of the excavator. However, the 20 implement would in effect be permanently attached to the excavator until repairs could be completed to the hydraulic closure ram used. In the case of the design described in New Zealand Patent No. 250811 the locking pin inserted into an aperture in the sliding plate employed would fix the plate in place and hence prevent the implement from being demounted from the excavator. However, although the safety concerns are alleviated, the locking pin used will be 25 firmly fixed in place preventing the implement from being removed from the excavator unless high forces are applied to knock the pin out of the aperture in the plate.

An improved connector or quick hitch design which addressed any or all of the above problems, or at least offered a useful choice, would be of advantage. Specifically a quick hitch design which addressed the above safety concerns and which also allowed some variability in the width or sizes of implements which could be attached to a vehicle such as an excavator or lifting arm

5 would be of advantage.

It is therefore an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description that is given by way of example only.

## 10 DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, the connection apparatus including a body arranged to be mounted on the prime mover, the body including,

a connection means for connecting the body to the implement,

15 the connection means including at least one recess within the body adapted to attach the implement to the connection apparatus, and

a locking member wherein said locking member is adapted to move to a first position in which the locking member engages the implement to lock the implement and the body together, and

20 said locking member being adapted to move to a second position in which the locking member is disengaged from the implement so that the implement can be demounted from the body, and

at least one compression piston and chamber which is adapted to resist the movement of the locking member to the second position to prevent the implement from being demounted from the body.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said connection means includes two recesses.

According to a further aspect of the present invention there is provided a connection apparatus

5 for connecting an implement to a prime mover, substantially as described above, wherein a first recess may be orientated so that an implement's first mounting pin will not ordinarily fall out of the first recess under the action of gravity, and wherein the second recess may be orientated so that a second mounting pin of the implement will ordinarily be held in place within the second recess by the locking member.

10 According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said second recess may be drilled or machined into the body by a user of the connection apparatus.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said

15 locking member is formed from at least one hook shaped element.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said at least one hook shaped element includes at least one substantially flat and/or horizontal inner surface.

20 According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said at least one hook shaped element includes two or more substantially flat and/or horizontal inner surfaces.

According to a further aspect of the present invention there is provided a connection apparatus

25 for connecting an implement to a prime mover, substantially as described above, wherein the

angle between the two or more substantially flat and/or horizontal inner surfaces is between 5° - 30°.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein the 5 angle is between 15° - 20°.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, which further includes a driving means adapted to move the locking member to the first position to engage with the implement, and to lock the implement and the body together, and to expand the volume 10 of the compression chamber so that fluid within said compression chamber would be compressed when the locking member is moved to the second position to demount the implement from the body.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said 15 driving means is in the form of at least one ram.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said at least one ram is powered hydraulically or pneumatically.

According to a further aspect of the present invention there is provided a connection apparatus 20 for connecting an implement to a prime mover, substantially as described above, wherein said driving means includes a safety valve to ensure the driving means stays substantially in place if there is a pressure drop in the driving fluid and/or supply line for same.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said 25 safety valve is a one way valve.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said at least one compression piston and chamber are formed from a chamber or compartment which includes an aperture through which gas or other fluid may escape, and a piston with a profile or 5 shape which is adapted to block an open end of the chamber to thus trap fluid within the chamber.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein a connection apparatus as claimed in claim 15, wherein said chamber also includes a second 10 aperture blocked by a bleed valve which is adapted to allow fluid to escape from the chamber without having to pass the piston head.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein the at least one compression piston and chamber may be mounted or arranged so that movement of the 15 locking member to the first position will cause the volume of the chamber closed by the piston to expand, and wherein movement of the locking member towards the second position will force the piston into the chamber, thereby compressing any fluid within same, which will in turn resist the motion of the locking member.

According to a further aspect of the present invention there is provided a connection apparatus 20 for connecting an implement to a prime mover, substantially as described above, wherein the connection apparatus is provided with a pair of said compression pistons and chambers.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said at least one compression piston and chamber are adapted to trap gas within each of the chambers 25 provided.

According to a further aspect of the present invention there is provided a connection apparatus for connecting an implement to a prime mover, substantially as described above, wherein said gas may be provided from the air in the surrounding environment.

For convenience only, reference throughout this specification will predominantly be made to the 5 present invention including a driving means to move the locking member, preferably in the form of a displacement ram. However, those skilled in the art should appreciate that the present invention does not necessarily require the use of a displacement ram or any type of dedicated means to move the locking member to function effectively. For example, the present invention may be adapted so that the locking member may be moved manually or through the provision of 10 a number of different types of rams to move the locking member, and reference to the use of displacement rams throughout this specification should in no way be seen as limiting. For example, in one embodiment the present invention may be configured as a manually operated apparatus where a locking member may be moved by the operator.

The present invention may be adapted to provide a connection apparatus that is used to connect 15 an implement to a prime mover. For convenience only, reference throughout this specification will predominantly be made to such a connection apparatus being formed as a type of quick hitch normally used to attach earthworking or demolition tools to the working arm of an excavator or like vehicle. However, those skilled in the art should appreciate that a connection apparatus formed in accordance with the present invention may be used to attach any type of implement or 20 working tool quickly and easily to any form of lifting or working equipment, and specific references to quick hitches and excavators throughout this specification should in no way be seen as limiting.

An implement formed in accordance with the present invention may be any type of apparatus or 25 arrangement of elements which is adapted to connect to actuator arm, boom or any piece of machinery that can operate the implement. Preferably such implements may be configured to cut, crush, crack, shear, dig, collect, or break up a number of different types of materials. For

example in some embodiments the present invention may be used in the demolition industry to provide an attachment which can perform some of the above functions on a demolition site.

Preferably the prime mover which the implement is adapted to connect to may be an excavator or any other similar type of heavy machinery. These types of machine are well known in the 5 demolition and construction trades and as such will not be described in detail throughout this specification. Those skilled in the art should appreciate that reference to a prime mover may encompass any type of machine which can be adapted to move or operate an attachment or implement configured in accordance with the present invention.

For convenience only, reference throughout this specification will predominantly be made to the 10 implement being connected or attached to the actuator or working arm of an excavator. An excavator may be any type of apparatus known in the art which includes such an actuator arm and which can be used to drive or operate an implement configured in accordance with the present invention.

In a preferred embodiment the connection apparatus or quick hitch may include a main body 15 which is mounted or mountable on the excavator arm and which forms a base or framework on which other working components of the quick hitch are arranged.

In a preferred embodiment the body may include or may be associated with a connection means used to connect an implement to the quick hitch. Preferably such a connection means may also provide the facility to connect the body to the working arm of an excavator. Such a connection 20 means may include at least one recess formed within the body which is adapted to attach the implement to the connection apparatus. At least one recess may be used to locate and fix in place a connection pin provided on the implement which (without the quick hitch) would normally be directly connected to the working arm of an excavator.

In a preferred embodiment such a connection means may include two recesses within the body 25 which are adapted to locate and lock in place two mounting pins of an implement. The first of these recesses may be oriented so that the implement's mounting pin will not fall out of the

recess under the action of gravity while the second may be orientated so that the mounting pin will be held in place within the recess by a locking member. Such a locking member may be moveable with respect to the body to allow the implement to be mounted and demounted easily from the quick hitch.

5 For convenience only, reference throughout this specification will predominantly be made to the connection means including two recesses used to connect or mount an implement to the quick hitch. However, those skilled in the art should appreciate that this configuration of the invention should in no way be seen as limiting as a quick hitch may initially be formed with a single recess only. The second of the recesses used to connect the implement's second mounting pin may be  
10 drilled or machined into the body by the purchaser or final user of the quick hitch to suit the width and dimensions of the particular implement they wish to connect using the quick hitch.

Preferably the present invention includes a locking member where this locking member is adapted to move between a first and a second position to lock an implement's mounting pin in place with a connection mean's recess, and also to release such a mounting pin from the  
15 connection mean's recess, respectively.

Preferably such a locking member may be formed from a hook shaped element similar to those known with respect to the prior art. This type of element can be slid laterally or pivoted between one of two positions to release or engage with an implement's mounting pin(s).

In a further embodiment the present invention may include a hook shaped element as a locking  
20 member wherein one inner side or surface of such a hook forms or includes a substantially horizontal and/or flat surface. Preferably such a flat surface may be located on the inner face of the hook which in use normally supports the weight of an implement's connection pin. The use of a flat surface within an inner surface of such a hook element allows the hook to easily support the weight of an attachment pin and associated attachment when connected to the quick hitch.  
25 Preferably in such an embodiment the locking element may also include an additional substantially flat inner surface(s) which may be orientated at an angle with respect to the horizontal surface discussed above. The angle between these two faces may be between 5° - 30°

but in a preferred embodiment may be approximately 15° - 20° and preferably approximately 18°. This angled surface(s) may be used to provide a wedging action when the locking means is moved to wedge and lock in place an attachment's locking pin. This feature of the invention ensures that minimal forces are required to keep the locking means held in place through the 5 wedging action of the angled surface provided.

Preferably the connection means of the present invention also includes a driving means which may provide an automated or powered facility to move the locking member discussed above. Preferably such a driving means may be formed by a single hydraulic or pneumatic ram that can be actuated by the invention's operator to mount or demount an implement from an excavator.

- 10 Preferably the driving means as discussed above may also include a safety valve which traps driving fluid within the ram system. A one way valve may be used to implement this feature of the invention to ensure that if there is a pressure drop of driving fluid along the supply line to the ram, the ram will still be held in place as fluid will be prevented from escaping the system through the one way safety valve provided.
- 15 For the sake of simplicity reference throughout this specification will also be made to the connection apparatus being configured in similar manner to the quick hitch disclosed with respect to PCT publication WO 00/70155. The connection apparatus of the present invention may include a similar type of body with a pair of recesses forming a connection means, and a locking member formed by a pair of hook shaped elements mounted on a plate which slides from 20 side to side within the body. Furthermore, the connection apparatus of the present invention will also be described as including a driving means formed from a double acting hydraulic ram which is used to slide the locking means plate backwards and forwards to mount and demount an implement from an excavator arm. However, those skilled in the art should appreciate that other different designs of quick hitches may also employ the novel aspects of the present invention and 25 reference to the above only throughout this specification should in no way be seen as limiting.

In one embodiment the connection apparatus may include at least one compression piston and chamber which is adapted to resist the movement of a locking member to a second position, which will in turn prevent the implement from being demounted from the body. Such components of the invention may provide an additional safety or failsafe feature to the resulting 5 quick hitch to prevent an implement from falling from the end of an excavator arm if the driving means fails.

Preferably a compression piston and chamber employed in the present invention may be formed from a chamber or compartment which includes an aperture through which gas or fluid may escape and a piston with a profile or shape which will block an open end of the chamber to trap 10 fluid or gas within the chamber. If required the chamber may also include a second aperture blocked by a bleed valve which will allow gas or fluid to escape from the chamber without having to pass the piston head. In use, the piston may include a driving shaft extending out away from the chamber that can be used to drive the piston into or pull the piston out of the compression chamber. As should be appreciated by those skilled in the art compressed gas or 15 liquid trapped within the compression chamber will resist the motion of the piston further into the chamber whereas movement of the piston out of the chamber will not be resisted.

In a preferred embodiment a compression piston and chamber employed with the present invention may be mounted or arranged within the quick hitch so that movement of the locking member to a first position to engage the implement will cause the volume of the chamber closed 20 by the piston to expand. Conversely, motion of the locking member towards the second position (where the locking means releases the implement's mounting pin) will force the piston into the chamber, thereby compressing any gas or fluid within same, which will in turn resist the motion of the locking member.

In a preferred embodiment the present invention may include a pair of compression pistons and 25 chambers located within the body with both of the pair of pistons and chambers being arranged so as to resist the motion of the locking means as it moves to demount an implement from the connection apparatus. However, those skilled in the art should appreciate that any number and

arrangement of compression pistons and chambers may be used in accordance with present invention. One, three, or more pistons and chambers may be provided depending on the size of both the chambers and the connection apparatus involved. Reference to the use of a pair of chambers and pistons only throughout this specification should in no way be seen as limiting.

- 5 Preferably compression chambers and pistons incorporated into the present invention may be adapted to trap gas within each of the chambers provided. In a further preferred embodiment the gas trapped may be air from the surrounding environment, eliminating the need to supply a reservoir of gas for the present invention. Such compression pistons and chambers may trap air within the chambers used to provide a failsafe or safety mechanism to the resulting quick hitch.
- 10 Furthermore, the provision of a bleed or release valve within each of the chambers also provides additional control of the forces or resistance to forces supplied by these elements of the invention.

For example in a preferred embodiment which includes the chambers and pistons which trap air the normal configuration of such elements will keep an implement locked onto the quick hitch even if hydraulic systems associated with the driving means fail. The implement may then be manoeuvred into a position where it is safe to be released from the quick hitch and bleed valves associated with each chamber may be opened. This will then allow the locking member to be moved to its second position to release the implement from the quick hitch.

- 15 It is envisaged that the orientation of the compression piston and chamber may preferably lie substantially parallel to the driving means or the plane or direction of movement of same. However, it is to be appreciated that the piston and chamber need not be used in this configuration. For example, if the connection apparatus or quick hitch used pivoting hooks, then the positioning and/or alignment and/or directions of travel of the pistons and chambers could be altered or reconfigured as appropriate.
- 20 This configuration of a connection apparatus as discussed above provides many potential advantages over the prior art.

The use of compression pistons and chambers will provide a fixed or standard force against the movement of a locking member irrespective of the size or dimensions of the implement to be attached to the quick hitch provided. This may be contrasted with the use of a spring that will apply a variable force to a locking means depending on how compressed or expanded the spring

5 is to fit the size or dimensions of the implement to be attached. This configuration of the invention in turn allows the recesses used to provide a connection means to be customised to fit a particular type and size of implement to the quick hitch. As the compression pistons and chambers employed will continue to apply the same reaction force to a locking member, irrespective of their positioning, the user of the quick hitch may bore a second recess within the

10 body of the quick hitch at a position which fits the width or dimensions of the implement they wish to attach. This second recess may be formed into the quick hitch in addition to the first recess normally opened or closed using the locking member.

Furthermore, the connections of the quick hitch or connection apparatus to the working arm of an excavator may also be customised by the end user. Portions of the body which normally

15 would include apertures used to receive locking pins engaged with an excavator arm may also be machined or bored into the appropriate portions of the body by the end user of the invention. This configuration of the invention allows a single design of quick hitch to be manufactured in large volumes and to be customised by its end user depending on the particular equipment they are employing. This greatly simplifies the design of the quick hitch providing a one size fits all

20 arrangement.

Furthermore, the use of a locking member being hook shaped with one substantially horizontal flat surface used to support an attachment's locking pin and a second angled surface used to bear against and wedge in place the locking pin reduces the forces that need to be applied by either the quick hitches driving means or a compression piston and chamber to hold an attachment's

25 locking pin in place. This provides advantages to the invention where a compression chamber and piston may wear over time and have its performance degrade - but will still be able to safely retain an attachment on the quick hitch provided.

**BRIEF DESCRIPTION OF DRAWINGS**

Further aspects of the present invention will become apparent from the following description that is given by way of example only and with reference to the accompanying drawings in which:

5 Figures 1 and 2 show perspective and side cross section views of two connection apparatus' configured in accordance with a preferred embodiment of the present invention.

**BEST MODES FOR CARRYING OUT THE INVENTION**

10 Figures 1 and 2 show perspective and side cross section views of two connection apparatus' configured in accordance with a preferred embodiment of the present invention. In the embodiments shown the connection apparatus 1 is formed from a main body 2 which in turn includes a number of apertures 3.

15 The first of these sets of apertures 3a are provided to locate a set of mounting pins connected to the working arm of an excavator or other similar type of lifting equipment. The second set of apertures 3b are provided to connect an implement (not shown) to the main body 2 of the connection apparatus 1. Together, all the apertures 3 form portions of a connection means provided to connect the apparatus 1 to an excavator and in turn connect an implement (not shown) to the apparatus.

20 Also included is a locking member, formed in the embodiments shown through a set of hook shaped elements 4 mounted on a sliding plate 5. The plate 5 may be slid within the body 2 to engage the hook elements 4 with a mounting pin 6 of an implement to be attached to an excavator using the connection apparatus 1. The implement may be secured in place through use of a second mounting pin 6a located within the second aperture 3b at the opposite end of the quick hitch from the hook elements 4.

25 Figures 1 and 2 show different embodiments of connection apparatus with variations in the shape of the locking means hook elements 4 provided in each apparatus. In the case of Figure 1 the

hook elements may include a substantially curved inner surface to engage with an implement's mounting pin 6, whereas the hook elements 4 shown with respect to Figure 2 may include a number of flat, horizontal and angled surfaces. In such an embodiment the first inner surface 4a may lie substantially horizontal with respect to the longitudinal axis of body 2 and will in use 5 support the weight of an implement mounting pin 6 in associated implement when connected to the apparatus 1. A second angled inner surface 4b may also be provided within such a hook element to wedge the hook up against an implement mounting pin 6 when the locking means is moved to lock the pin in place. The use of such an angled or wedged shaped inner surface substantially reduces the forces that need to be applied to hold or lock the pin in place within the 10 apparatus 1. The angle which this face makes with respect to the first flat surface 4a in the embodiment shown is 18°.

In use a driving means, shown in this embodiment as a double acting hydraulic ram 7 may be used to move the mounting plate 5 backwards and forwards to in turn release or engage an implement mounting pin 6 within an associated recess 3b.

15 The connection apparatus 1 also includes a pair of compression pistons 8 and chambers 9 mounted alongside the ram 7. Each of the pair of compression chambers 9 and pistons 8 is adapted to resist motion of the sliding plate 5 which would release the mounting pin 6 from the hook elements 4. This re-active or resistance force is supplied through gas being trapped within the chambers 9 by the pistons 8 where this gas is compressed by any motion of the sliding plate 5 20 in the direction which will release the pin 6 from the recess 3b. Conversely when the hook elements 4 are moved towards the mounting pin 6 there is no resistance or re-active force supplied by the pistons 8 and chambers 9 as the motion in this direction will expand out the volume of the chambers 9.

Modifications may also be made to the design of the connection apparatus shown with respect to 25 Figure 1. The body 2 may be supplied to an end user without any of the recesses 3a formed within same. A user of the apparatus may bore these recesses into the body themselves depending on the particular type of lifting or excavation machinery with which the invention is

to be used. Furthermore, of the second set of recesses 3b provided within the apparatus only the recess which the hook elements 4 open and close may be provided. The second of these recesses may be bored or machined into the body 2 by an end user depending on the particular dimensions and width of the implements to be mounted using the present invention.

- 5 Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE:

1. A connection apparatus for connecting an implement to a prime mover, the connection apparatus including a body arranged to be mounted on the prime mover, the body including;

5 (a) a connection means for connecting the body to the implement,

(b) the connection means including at least one recess within the body adapted to attach the implement to the connection apparatus,

(c) a locking member wherein said locking member is adapted to move to a first position in which the locking member engages the implement to lock the implement and the body together,

10 (d) said locking member being adapted to move to a second position in which the locking member is disengaged from the implement so that the implement can be demounted from the body,

(e) at least one compression piston and chamber which is adapted to resist the movement of the locking member to the second position to prevent the implement from being demounted from the body.

2. A connection apparatus as claimed in claim 1 wherein said connection means includes two recesses.

3. A connection means as claimed in claim 2, wherein a first recess may be orientated so that an implement's first mounting pin will not ordinarily fall out of the first recess under the action of gravity, and wherein the second recess may be orientated so that a second mounting pin of the implement will ordinarily be held in place within the second recess by the locking member.

4. A connection apparatus as claimed in claim 2 or claim 3 wherein said second recess may be drilled or machined into the body by a user of the connection apparatus.
5. A connection apparatus as claimed in any one of claims 1 to 4 wherein said locking member is formed from at least one hook shaped element.
- 5 6. A connection apparatus as claimed in claim 5 wherein said at least one hook shaped element includes at least one substantially flat and/or horizontal inner surface.
7. A connection apparatus as claimed in claim 5 or claim 6 wherein said at least one hook shaped element includes two or more substantially flat and/or horizontal inner surfaces.
8. A connection apparatus as claimed in claim 7 wherein the angle between the two or more substantially flat and/or horizontal inner surfaces is between 5° - 30°.
- 10 9. A connection apparatus as claimed in claim 8 wherein the angle is between 15° - 20°.
10. A connection apparatus as claimed in any one of claims 1 to 9, which further includes a driving means adapted to move the locking member to the first position to engage with the implement, and to lock the implement and the body together, and to expand the 15 volume of the compression chamber so that fluid within said compression chamber would be compressed when the locking member is moved to the second position to demount the implement from the body.
11. A connection apparatus as claimed in claim 10, wherein said driving means is in the form of at least one ram.
- 20 12. A connection apparatus as claimed in claim 10 or claim 11, wherein said at least one ram is powered hydraulically or pneumatically.
13. A connection apparatus as claimed in any one of claims 10 to 12, wherein said driving means includes a safety valve to ensure the driving means stays substantially in place if there is a pressure drop in the driving fluid and/or supply line for same.

14. A connection apparatus as claimed in claim 13, wherein said safety valve is a one way valve.

15. A connection apparatus as claimed in any one of claims 1 to 14, wherein said at least one compression piston and chamber are formed from a chamber or compartment which includes an aperture through which fluid may escape, and a piston with a profile or shape which is adapted to block an open end of the chamber to thus trap fluid within the chamber.

16. A connection apparatus as claimed in claim 15, wherein said chamber also includes a second aperture blocked by a bleed valve which is adapted to allow fluid to escape from the chamber without having to pass the piston head.

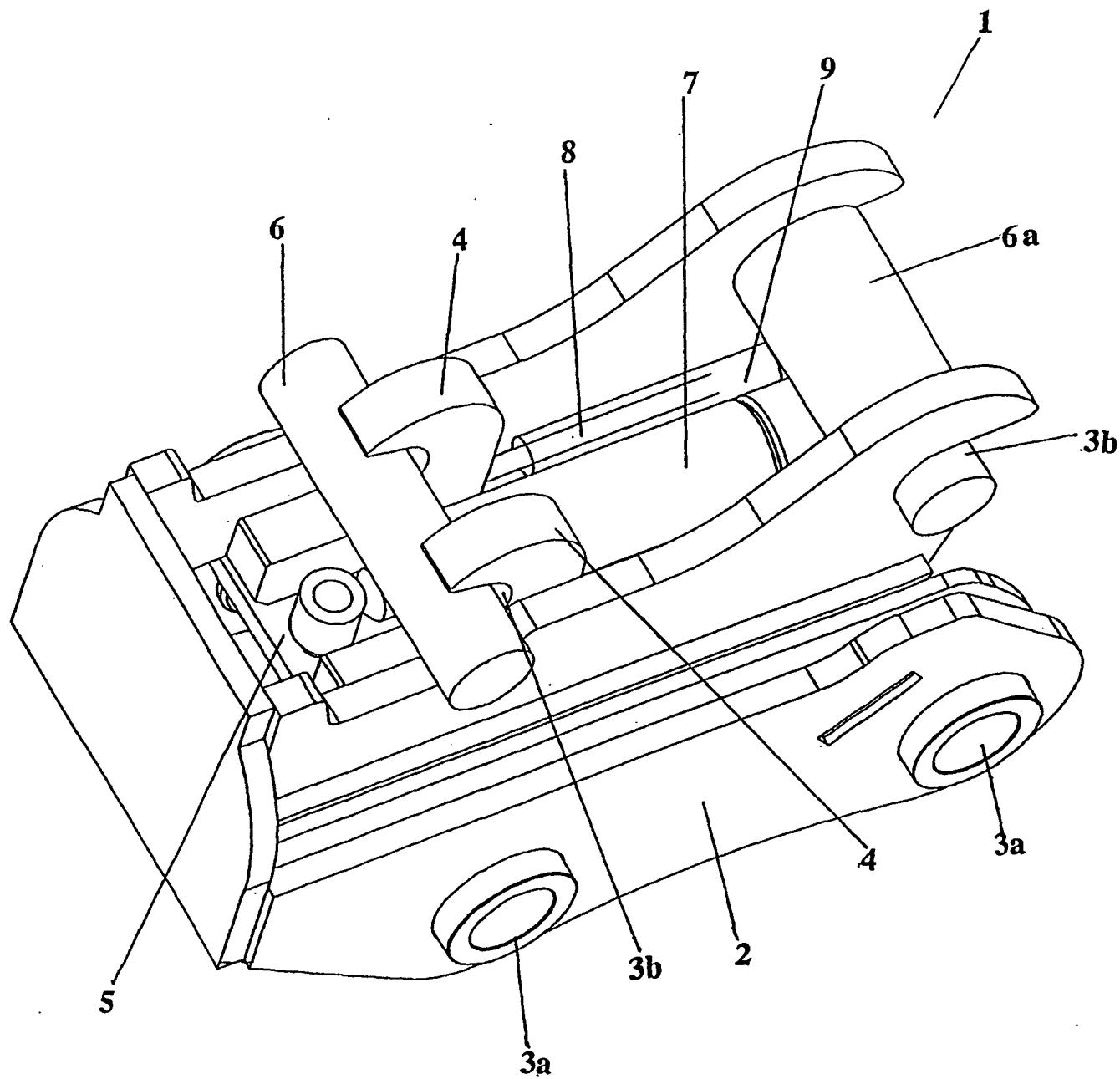
17. A connection apparatus as claimed in claim 15 or claim 16, wherein the at least one compression piston and chamber may be mounted or arranged so that movement of the locking member to the first position will cause the volume of the chamber closed by the piston to expand, and wherein movement of the locking member towards the second position will force the piston into the chamber, thereby compressing any fluid within same, which will in turn resist the motion of the locking member.

18. A connection apparatus as claimed in any one of claims 15 to 17, wherein the connection apparatus is provided with a pair of said compression pistons and chambers.

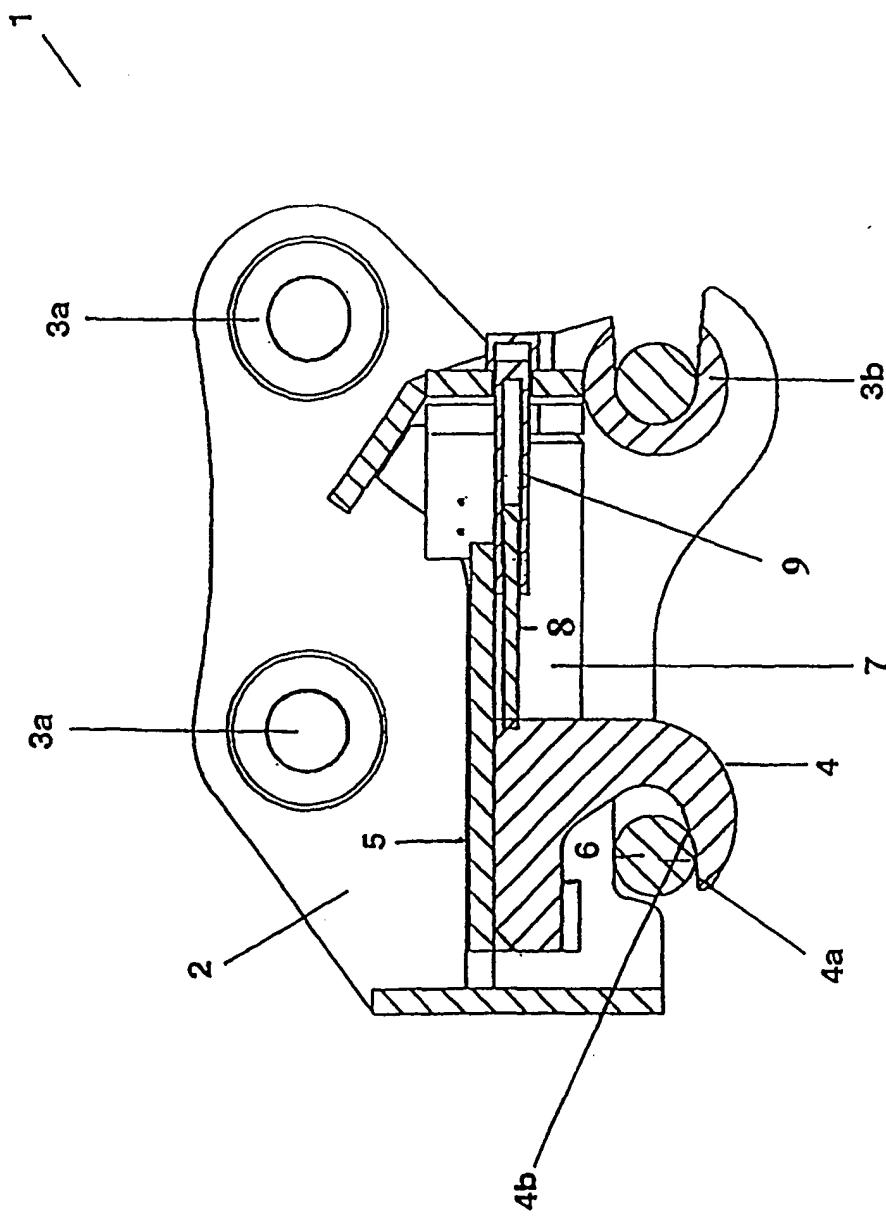
19. A connection apparatus as claimed in any one of claims 15 to 18, wherein said at least one compression piston and chamber are adapted to trap gas within each of the chambers provided.

20. A connection apparatus as claimed in claim 19, wherein said gas may be provided from the air in the surrounding environment.

21. A connection apparatus as claimed in any one of claims 10 to 20, wherein said at least one compression piston and chamber lies substantially parallel to the longitudinal axis of the body and/or the direction of movement of the driving means.
22. A connection apparatus as claimed in any one of claims 1 to 21, wherein the connection apparatus is adapted to connect an appropriate implement to an excavator arm.
23. A method of connecting an implement to a prime mover, utilising the connection apparatus as claimed in any one of claims 1 to 22.
24. A connection apparatus substantially as herein described and with reference to the accompanying drawings and/or examples.
- 10 25. A method of attaching an implement to a prime mover utilising the connection apparatus, substantially as herein described and with reference to any of the drawings and/or examples.



**Figure 1**



**Figure 2**

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/NZ 02/00083

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E02F3/36

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category <sup>a</sup>	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 890 871 A (WOERMAN GARY R) 6 April 1999 (1999-04-06) figures 3-5	1, 10
A	column 3, line 53 - line 58 column 4, line 4 - line 11 column 4, line 31 - line 43 ----- EP 0 671 512 A (ORENSTEIN & KOPPEL AG) 13 September 1995 (1995-09-13) column 4, line 32 - line 57 column 5, line 32 - line 50 figures 1, 2 ----- -----	2, 3, 11, 12, 15, 17, 19, 21-25
A		1

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 578 447 A (FERMEC MFG LTD) 12 January 1994 (1994-01-12) figure 7 ---	1
A	WO 00 70155 A (SHORT BRUCE ARCHIBALD) 23 November 2000 (2000-11-23) figures 4,5 ---	1
P,A	US 6 231 296 B1 (BLOMGREN STIG) 15 May 2001 (2001-05-15) figures 9,10 ---	1

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Information on patent family members

International Application No

PCT/NZ 02/00083

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